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The Experimental Status of Baryon Resonances

VOLKER CREDE, Florida State University

Nucleons are complex systems of confined quarks and exhibit characteristic spectra of excited states. Highly excited nucleon states are sensitive to details of quark confinement which is poorly understood within Quantum Chromodynamics (QCD), the fundamental theory of strong interactions. Thus, measurements of excited nucleon states and the corresponding determination of their properties are needed to come to a better understanding of how confinement works in nucleons. However, the excited states of the nucleon cannot simply be inferred from cleanly separated spectral lines. Quite the contrary, a *spectral analysis* in nucleon resonance physics is challenging because of the fact that these resonances are broadly overlapping states which decay into a multitude of final states involving mesons and baryons. To provide a consistent and complete picture of an individual nucleon resonance, the various possible production and decay channels must eventually be treated in a multi-channel framework that permits separating resonance from background contributions. A long-standing question in hadron physics is whether the large number of so-called *missing* baryon resonances really exists, i.e. experimentally not established baryon states which are predicted by quark models based on three constituent quark effective degrees of freedom. It is important to emphasize that nearly all existing data on non-strange production of baryon resonances result from πN scattering experiments. However, quark models predict strong couplings of these *missing* states to γp rendering the study of these resonances in photo-induced reactions a very promising approach. Several new states have in fact been proposed in recent experiments. Current and upcoming experiments at Jefferson Laboratory will determine polarization (or spin) observables for photoproduction processes involving baryon resonances. Differences between the predictions for these observables can be large, and so conversely they provide strong constraints on the analysis. An interesting question is whether it is possible to design a complete set of experiments which will uniquely determine the scattering amplitude for a given process. The current effort with the CLAS detector at Jefferson Lab is to utilize highly-polarized frozen-spin (butanol) and deuterium targets in combination with polarized photon beams. In particular, the very successful FROST experiment took the first double-polarization data from November '07 to February '08 paving the way for a *complete experiment* in $K\Lambda$ and $K\Sigma$ photoproduction. This contribution will review recent results and also discuss open questions and perspectives in N^* physics.